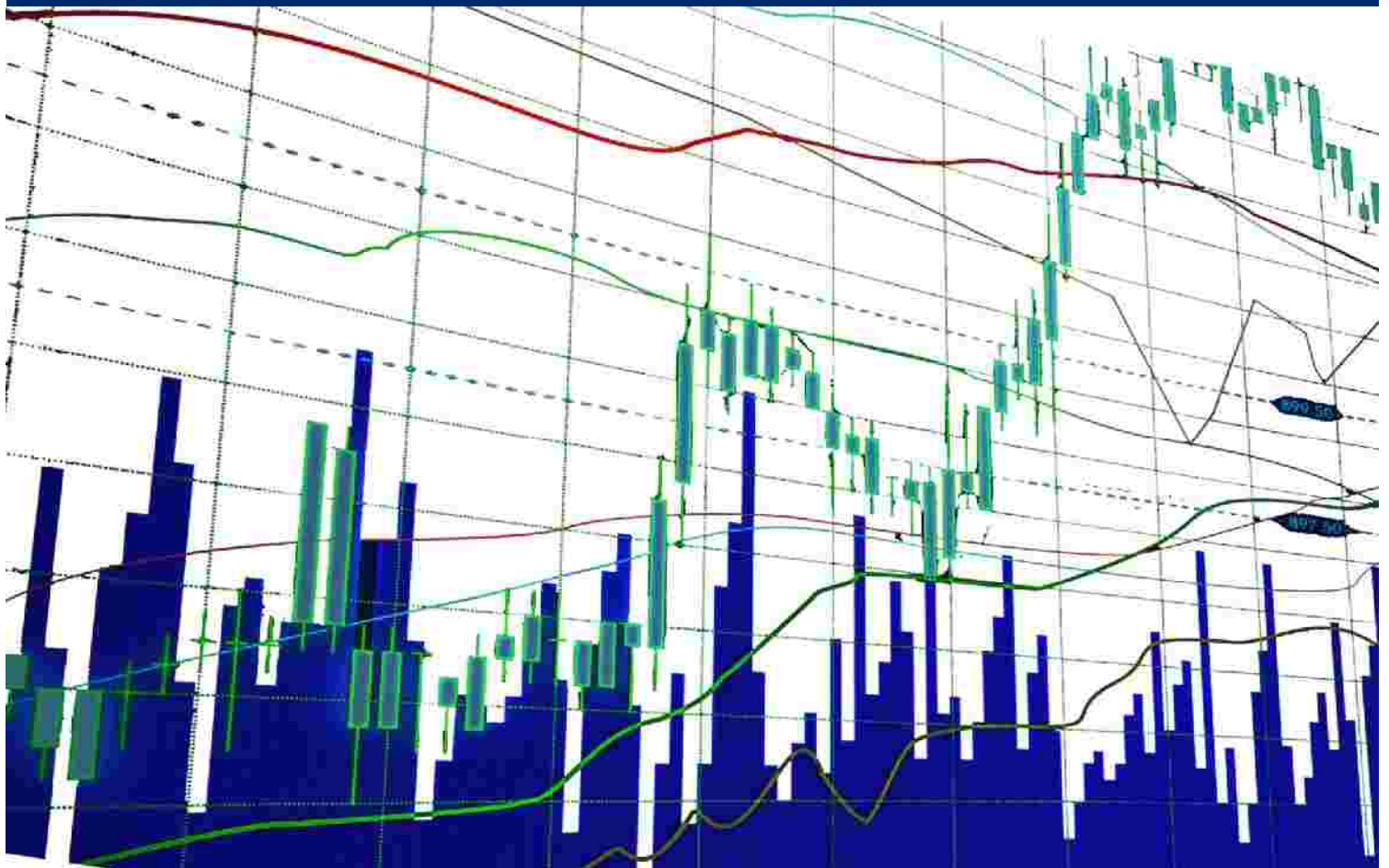




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Hydropower Investment Promotion Project (HIPP)

OVERVIEW OF COMPETITIVE POWER MARKETS AND THE ELECTRICITY SECTOR IN GEORGIA



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USAID HYDROPOWER INVESTMENT PROMOTION PROJECT
(HIPP)

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Acronyms Used in this Report:

BM	Balancing Market
BPM	Balancing Power Market
DAM	Day-Ahead Market
EMRA	Electricity Market Regulatory Authority of Turkey
ESCO	Electricity System Commercial Operator of Georgia
EU	European Union
EUAS	Electricity Generation Company of Turkey
GEMM 2015	Georgian Electricity Market Model 2015
GNERC	Georgian National Energy and Water Supply Regulatory Commission
GoG	Government of Georgia
HIPP	Hydropower Investment Promotion Project
HPP	Hydro Power Plant
IT	Information Technology
MFSC	Market Financial Settlement Center (Turkey) (Piyasa Mali Uzlastirma Merkezi –PMUM)
MO	Market Operator
NLDC	National Load Dispatch Center in Turkey
PX	Power Exchange
TEDAS	Turkish Electricity Distribution Company
TEIAS	Turkish Electricity Transmission Company
TSO	Transmission System Operator

1. INTRODUCTION

In this report, USAID-funded Hydropower Investment Promotion Project (HIPP) describes its vision about the electricity market development in the Georgian Electricity Market Model (GEMM 2015). GEMM 2015 is plan, agreed to by Georgian officials, that provides steps to be taken by the Government of Georgia (GoG) and various market participants in order to develop Georgia's competitive electricity sector in compliance with the market's vision of the GoG. It represents a guide for fundamental but gradual legal and functional changes in the Georgian electricity market structure, in accordance with the EU competitive electricity market principles.

GEMM 2015 sets forth, inter alia, the creation of independent market operator (MO) and transmission system operator (TSO). The MO will be responsible for electricity balancing and settlement services, thereby improving the reliability and transparency of market operations and functions. The TSO will be responsible for the security and adequacy of the system.

This report describes different necessary markets in a competitive electricity sector, based on international best practices. The report is structured as follows: Section 2 provides a synopsis of the Georgian electricity balancing market along with its operational rules and procedures. Section 3 provides a description of competitive electricity market. Section 4 overviews existing power markets using best international practices. Section 5 provides analysis and suggestions on the development of the market in Georgia.

2. SYNOPSIS OF A BALANCING MARKET

A Balancing Market is an organized wholesale electricity market, which is operated by a Market Operator (MO, the financial aspect of the market) and the Transmission System Operator (TSO, the technical coordination). In the Balancing Market, electricity is sold or purchased, in order to serve the purpose of real-time balancing of demand and supply. Considering various unpredictable events and errors, it may leave a gap between electricity supply and demand which causes electricity imbalance in the system. For this reason, a balancing mechanism is needed to keep the balance of load and generation in the system, and to provide system stability.

2.1 DESCRIPTION OF THE CURRENT GEORGIAN SETTLEMENT MARKET

Currently, there is a bilateral wholesale market in Georgia which covers about 80% of power trade. Plus there is another 20% of wholesale market trading in the Georgian electricity market which is executed by ESCO. ESCO's services include the sale and

purchase of electricity, settling electricity trades and/or guaranteed capacity between the entities authorized for such activity. According to the Georgian Electricity (Capacity) Market Rules, adopted in 2008 and amended in 2012 ("Market Rules") wholesale trade is performed through direct contracts or through ESCO under standard terms. The direct contracts for power purchase are signed between the eligible entities, and also between the eligible entities and transmission or dispatch licensee, who, in accordance to the legislation in force, are granted a right to participate in the electricity ale trade.

The service of settling electricity wholesale trades is conducted by ESCO. It works as follows: sale and purchase of balancing electricity is conducted under standard conditions. Standard conditions represent standard contractual terms made by the ESCO for the wholesale trade participants, and include direct contracts between ESCO and qualified enterprise for buying and selling electricity in the balancing market.

Under the standard conditions in direct contracts, qualified enterprises have certain rights and obligations for participating in balancing electricity trade. Standard conditions regulate terms of balancing electricity trade, settlements, payments and penalties. According to these conditions, the ESCO purchases electricity from eligible enterprises such as an electricity generator or an importer. ESCO buys the electricity from eligible generation enterprise equal to the difference between the electricity delivered by the eligible enterprise and the electricity amount sold by such enterprise, based on the direct contract. However, in practice, ESCO revises contracted trading volumes retrospectively, so there is no deviation between contracted energy and actual energy delivered.

In case of electricity import, ESCO buys the difference between the electricity amounts imported by importer and sold by such importer, based on a direct agreement. Furthermore, at the option of the power producer, ESCO is obliged to buy electricity generated by newly built HPPs, based on a direct contract executed under current legislation between the eligible enterprise, HPP owner and ESCO. On the other hand, ESCO sells electricity to eligible enterprises such as distribution companies, direct consumers and exporters on its balancing market. Balancing electricity purchased by an eligible enterprise is equal to the difference between the amount of electricity consumed by them during the settlement period and the electricity, purchased based on the direct contract.

For balancing electricity trade, ESCO is supposed be responsible for the determination of the volume and price of the balance electricity in compliance with the market rules. According to the existing Market Rules, the price for purchase balancing electricity by ESCO is determined as follow:

- When an eligible enterprise is the owner of regulatory plant with a fixed tariff, the price of its balancing electricity is equal to the generation tariff set by GNERC;

- When 1) an eligible enterprise is the owner of a power plant with an adjustable upper marginal tariff, or 2) deregulated HPPs; the following should apply:
 - From September 1 till May 1 of each calendar year – the price is equal to the upper marginal tariff of electricity generation, set by the GNERC for relevant eligible enterprise;
 - From May 1 till September 1 the tariff should be equal to the fixed tariff of the regulated power plant with the lowest generation tariff set by GNERC;
- In the case of an owner with a thermal power plant, its balancing electricity price is set to its upper marginal tariff for generation, set by the GNERC;

Under the Market Rules, for balancing electricity sales, ESCO uses weighted average prices, which are calculated using volumes and prices for purchased balancing electricity. The current structure called for in the Market Rules, for the Georgian Balancing Market is described in Figure 1.

Figure 1. Structure as per Market Rules for the Georgian Balancing Market



To have a proper information exchange, the dispatch center (in GSE) provides all necessary information to ESCO, which in turn calculates volume and price for balancing electricity on a monthly basis¹. Note that ESCO's operation, as per Market Rules, is not structured as a traditional Market Operator in a typical competitive power market. This is explained below.

3. DESCRIPTION OF A COMPETITIVE POWER MARKET

Over the last several decades, reforms in many electricity sectors worldwide were framed by deregulation, and were accompanied by the establishment of new and different types of electricity markets and trading mechanisms. The main motivation behind the electricity market deregulation was to create an efficient trading process that unleashed the forces of competition, and to create a market with robust system security and reliability. Also it was meant to fairly balance the interests of consumers and producers by using least-cost generation sources. Reform, ultimately, was supposed to

¹ According to ESCO, the calculation is done in arrears, making a true-up in the contracted volumes for bi-lateral contracts.

reduce electricity prices over time. Many energy economists suggested that under a monopoly structure of the electricity sector, there were not optimal investment incentives and the system cost was also too high. Furthermore, consumers were not able to choose suppliers while there was only a monopoly providing services to the customers. In general, energy economists characterized monopoly structure of the electricity sector as having:

- Limited incentives for efficient functioning of the sector;
- Unnecessary investment planning and utilization;
- Costs of mistakes in the electricity system paid by the consumers;
- Government was one of the largest participants and in could easily interfere electricity sector functioning, especially in emerging markets.

Reforms in the electricity sector were implemented in various countries in a different ways. Supporters of electricity sector restructuring argued that new structures of the electricity sector should:

- Encourage and increases competition;
- Increase number of market participants;
- Establish various trading mechanisms allowing market participants to plan and realize their positions efficiently;
- Increase role and responsibility of the regulatory body which efficiently monitors market participants activities and ensures non-discriminatory relationship among behaviors;
- Ensure energy security of the country;
- Encourage optimal investments in the sector;
- Create additional institutions such as TSO, MO and Market Clearing House, which efficiently allocate physical and financial transactions among market participants;
- Support IT platform and software development which enables electricity market participants to interact with each other close to real time;
- Allocate the risk to all market participants fairly and appropriately;
- Increases market size and liquidity;
- Establish transparent and non-discriminatory prices;
- Establish efficient settlement procedures among market participants; and,
- Reduce monopoly power in the market.

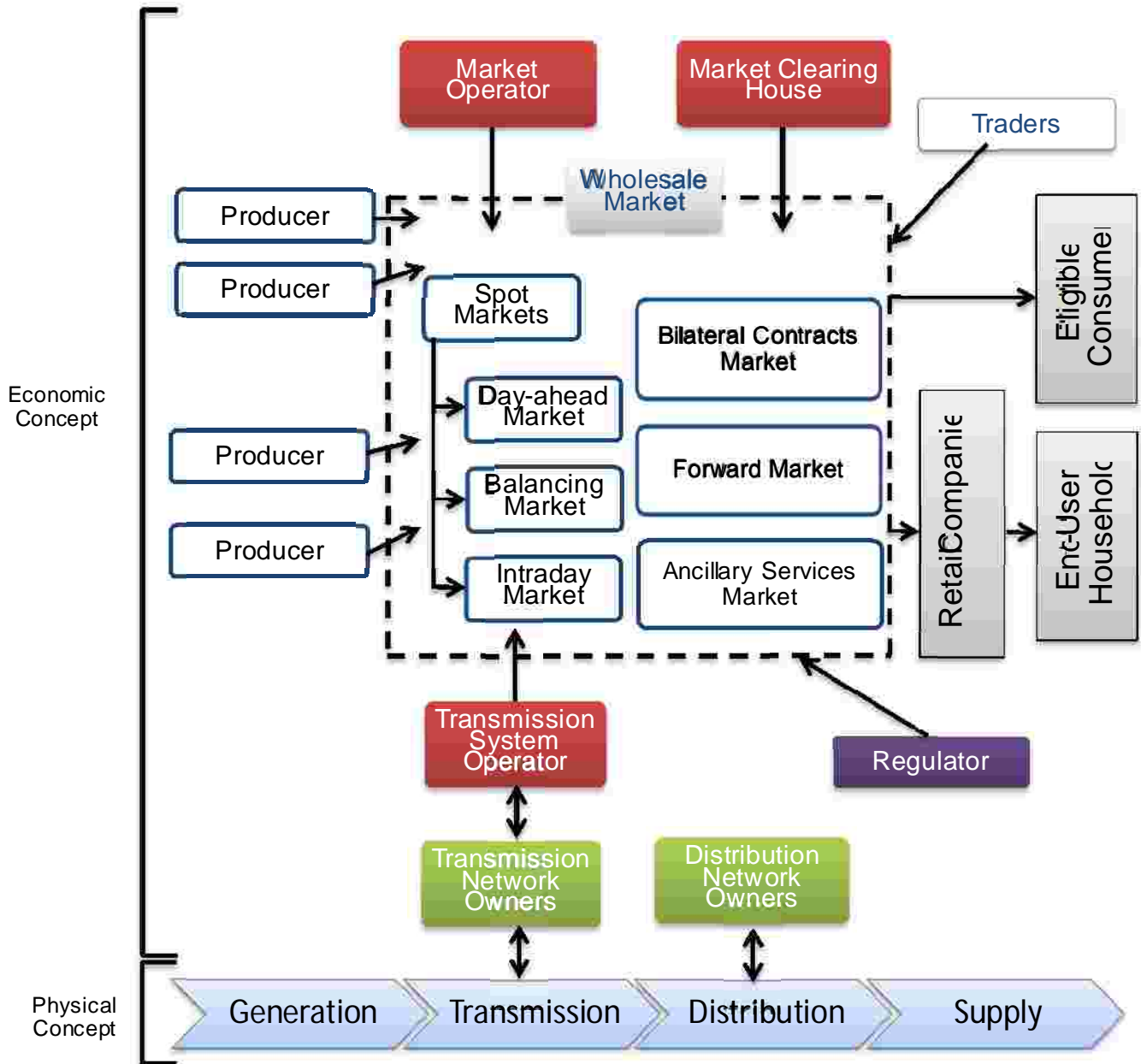
Considering the abovementioned factors and physical characteristics of electricity (it can't be stored, must be continuously in balance), competitive electricity market requires various trading mechanisms such as bilateral contracts, spot markets, forwards and futures, balancing and ancillary services markets which enable market participants to efficiently plan their positions in the market and minimize costs and financial risk.

A competitive wholesale market structure usually follows a traditional three-part segmentation (unbundling generation, transmission, and distribution), which emphasizes competition in the generation market. Also, a competitive electricity market provides a centralized framework and effective regulation that are designed to produce an economical electricity service. Certain prerequisite conditions are critical, amongst the most important is that the competitive market presumes a large number of competitors, with no barriers to entry or exit.

In competitive electricity markets, real-time operation of the electricity system requires coordination between TSO and MO, and among market participants, in order to ensure continuous balance between electricity supply and demand. Therefore, balancing mechanism enables market participants execute balancing actions and procedural adjustments in their positions to maintain balance and reliability of the system.

The Balancing Market is an integral part of the overall electricity trading processes. While electricity trading timetable extends from months to years before the actual trade can take place, deviations from the settlements can be occurred in real time. Within balancing market buyers and sellers are able to submit bids and offers for their deviations in bilateral contracts. Structure of the competitive electricity market and relationships among different market participants and its market service providers is shown in the Figure 2.

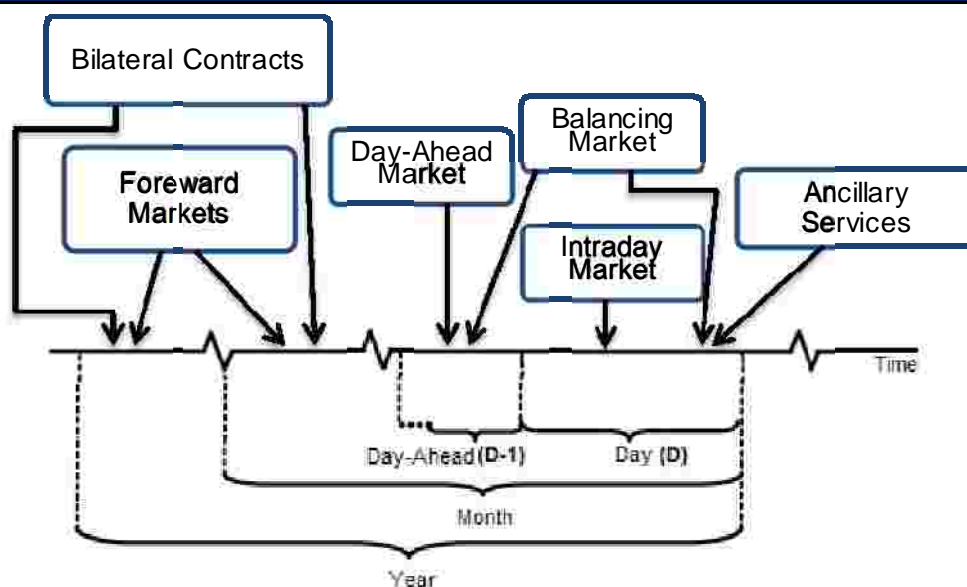
Figure 2. Competitive Electricity Market Structure



3.1 COMPETITIVE ELECTRICITY TRADING MECHANISMS

The establishment of a competitive electricity market and its trading mechanisms should establish the liquidity and size of the market. A good framework helps market participants to function in a transparent and non-discriminatory basis, and there is a need to continually monitor market behavior to eliminate market power. Figure 3 shows interaction of different trading mechanisms within different timeframes under competitive electricity market structure.

Figure 3. Interaction of Different Trading Mechanisms and Markets



Along with bilateral agreements which are basically are long-term, competitive electricity market also includes balancing market or mechanism. A fully liberalized electricity market usually includes balancing, day-ahead, and intra-day markets operated by MO. In addition, there are organized markets for procurement of ancillary services. The aforementioned descriptions relate to energy markets. Many jurisdictions are also now developing capacity markets as well as energy markets.

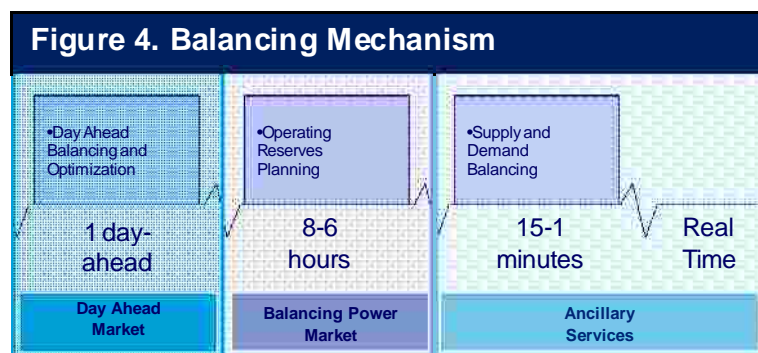
3.1.1 BALANCING POWER MARKET

Once the day-ahead market is closed, the MO selects the winning bids, and issues instructions related to market participants bids and offers. In general the electricity system is always balanced, so total generation equals to the total consumption. In real time market participants may incur imbalances in the system via producing and consuming below or above their submitted bids and offers. Consequently, these imbalances require electricity generators and consumers which are flexible in their generation and consumption to decrease or increase their electricity generation and

consumption. In this case, balancing power market procedures is applied so it allows flexible generators and consumers to submit their bids and offers in advance and execute it in real time. Participants of balancing power market are registered as balancing entities which are able to increase or decrease their generation or consumption in 15 minutes ahead. Balancing power market instructions can be issued at any time of the related day by the TSO. System marginal prices for each hour are determined in four hours' time following the related hour and are announced to market participants by the TSO. Balancing power market operational processes are the following:

- Operational processes on balancing power market starts after the activities on the DAM are completed, at 14:00 hours;
- Participants of balancing power market (BPM) notify TSO by 16:00 hours regarding their up or down regulation bids and final daily generation schedules containing the hourly generation or consumption values;
- After submission of up and down regulations by BPM participants, TSO checks notifications, identifies errors if any by 17:00 hours and publishes final results of BPM procedures.

Figure 4 below describes the balancing mechanism and its sub-markets.



Source: DTT Turkey

3.1.2 DAY-AHEAD MARKET

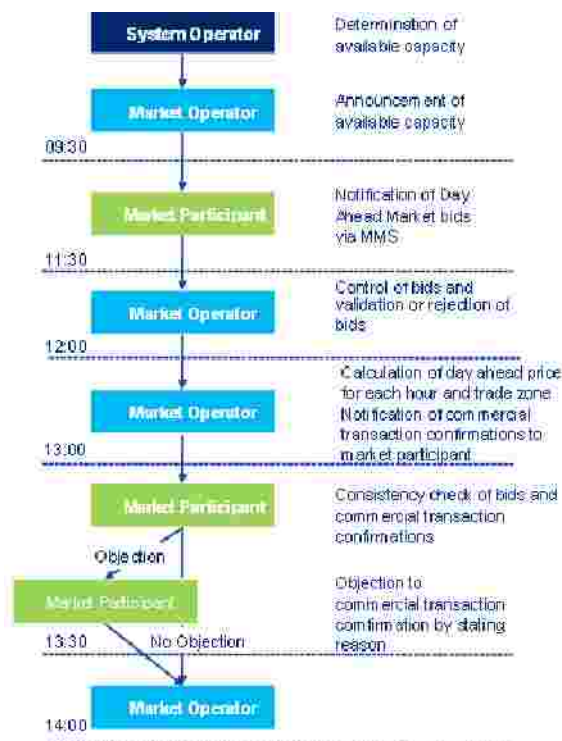
A Day-Ahead Market (DAM) in electricity is commonly applied in European countries and all over the world. The DAM is an organized wholesale spot electricity market operated by a MO, in which purchases and sales of electricity are conducted on day-ahead basis. A well-organized DAM provides the opportunity to the market participants to balance their generation and consumption under the obligation of a bilateral contract, and ensures balance in the system at a day-ahead forward stage. It is executed on daily basis and its operational processes may be as follow (the example is from the Turkish DAM):

- Every day by 9:30 AM, the MO informs all market participants about the hourly allocation of available transmission capacity determined by the TSO;

- After analysing information provided by the MO regarding available transmission capacity, market participants submit their bids and offers to the MO in order to sell and buy electricity for each specific hour within the following 24 hours. This step of DAM processes ends at 11:30 AM. The interaction between market participants and MO is conducted through an IT platform;
- Once the MO receives all bids and offers from market participants, the MO checks and verifies all information by 12:00 PM. After the information is verified, all market bids and offers become firm, so market participants are not able to change them. However, market participants are able to modify their bids or offers, if the MO rejects them and notifies on errors.
- During 12:00 PM and 13:00, the MO calculates, for each hour, the market clearing price and quantity of electricity within 24 hours and publishes it.
- After the information on commercial transactions is published, the market participants check the accuracy of the information during 13:00 – 13:30 hours and in case of mistakes they submit their objections to the MO.
- Finally, the MO evaluates every objection and notifies market participants regarding the objection results until 14:00. Thus, activities on DAM are complete.

Graphically, all DAM processes can be described as in Figure 5.

Figure 5. DAM Processes



Source: DTT Turkey

3.1.3 INTRADAY MARKET

An Intraday Market is conducted between the DAM and the balancing power market. The Intraday Market is one of the major components of the balancing mechanism. The main idea of an intraday market is to reduce imbalances in the system by creating additional purchase and sale options for the market participants.

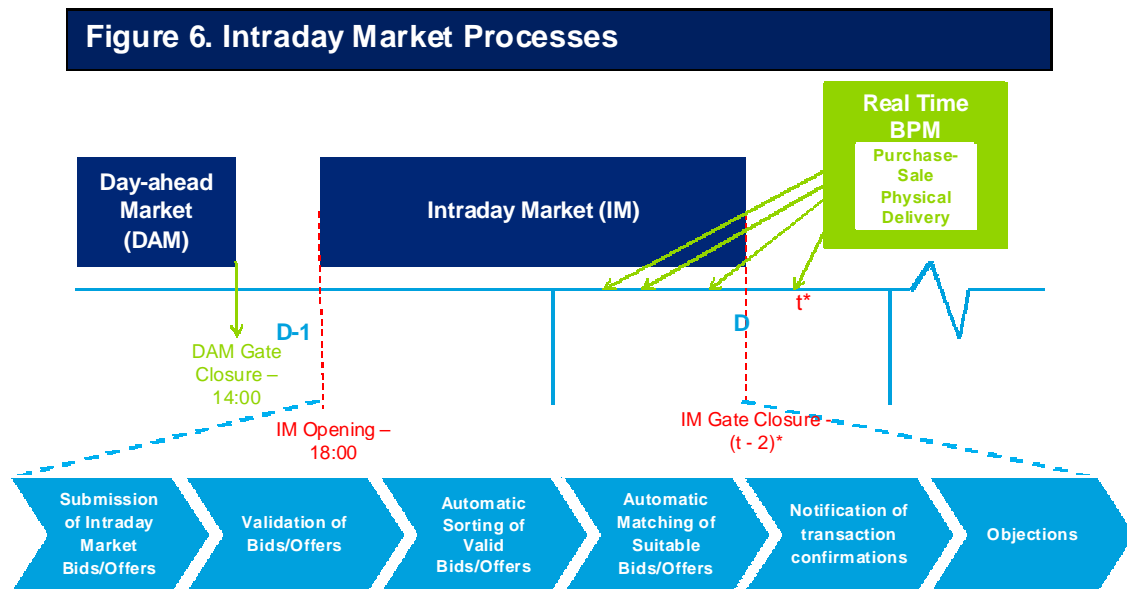
An intraday market works as follows: After the operations on the DAM are completed, market participants are able to readjust their generation and consumption in intraday market. Intraday market is operated until a couple of hours before the actual delivery of electricity. Trade in the DAM and actual physical delivery of electricity has a lag. So, in addition to DAM, the intraday market is introduced for more precise and accurate balance of power system. First of all, DAM does not consider all technical aspects of power plants and consumption utilities. So there is not difference in DAM trade and any ordinary electricity trade. However, there might be some failures that may arise due to problems in electricity generation and consumption. Thus intraday market helps to overcome such problems by having trading occur closer to real time. Secondly, the intraday market helps to reduce real time uncertainties, such as power plant breakdown or changes in weather forecast.

Intraday market trading is widely applied in Europe electricity markets and many non-European countries are trying to implement it in their electricity system. Along with the DAM, intraday market is administered by the MO. Procedures for operations in the intraday market are similar to the processes on DAM. Transactions in intraday market are executed daily on an hourly basis. However, time schedule is different. On DAM transactions are executed on day-ahead (24 hours) while on intraday markets transactions are executed within hourly intervals for each day. Hourly time intervals vary country by country from 8-2 hours.

Operations in intraday markets are as follow:

- Purchase bids and sales offers that are accepted in intraday market incur the obligation of physical electricity supply and demand for the relevant market participant;
- MO is a counterpart for each intraday market participant, for all the transactions concluded in the day ahead market;
- All operations in intraday market may occur at any time before 2 hours from physical delivery;
- Intraday market operations will be conducted by continuous trade method.

Design of Turkish Example of its intraday market processes is shown in Figure 6.

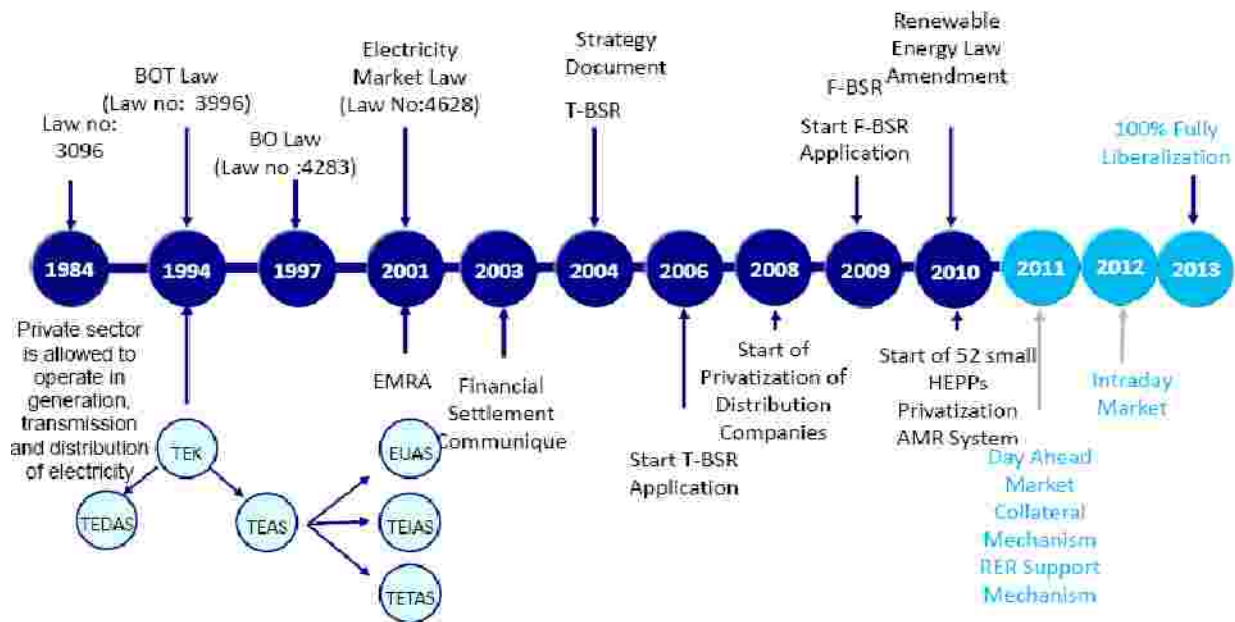


Source: DTT Turkey

4. OVERVIEW OF TURKISH ELECTRICITY MARKET

The Turkish electricity market had been previously dominated by state-owned vertically integrated companies. In 2001, Turkish government introduced Law #4628 which gradually changed Turkish electricity market from monopoly to competitive structure. Enforcement of primary and secondary legislation together with active engagement of Electricity Market Regulatory Authority (EMRA) ensured the transformation of the market from a single buyer model to full retail competition which is basically a lateral contracts model supplemented by a balancing mechanism. The reform process in the Turkish electricity market with important years and milestones is shown in the Figure 7

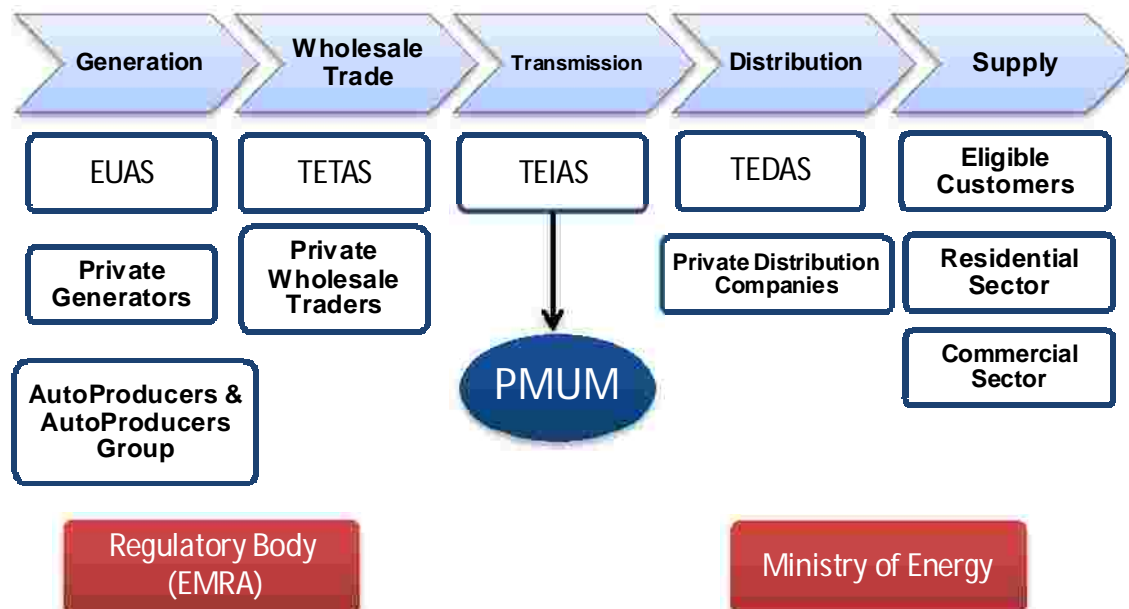
Figure 7. Reform Process in Turkish Electricity Market



Under the current Turkish electricity market structure, electricity transmission activities are conducted by state-owned Turkish Electricity Transmission Company (TEIAS). Besides its transmission activities, TEIAS also conducts activities such as load dispatch and frequency control. The Market Financial Settlement Center (MFSC) or PMUM is also under TEIAS as a separate unit. The PMUM is responsible for the DAM, and the Balancing Market.

The Detailed structure of current Turkish electricity market is shown in the Figure 8.

Figure 8. Current Structure of the Turkish Electricity Market



The Turkish electricity market consists of bilateral contracts market, DAM and balancing market which is regulated by balancing and settlement regulation. Under reforms scheduled for 2014 or 2015 to be finalized, the structure of Turkish electricity market will change from current structure and will consist 5 sub-markets:

- Bilateral contracts market between the market participants;
- Day-ahead market;
- Real-time system balancing and operational mechanism,
- Organized market for financially settled electricity contracts and
- One or more organized markets for procurement of ancillary services

Figure 8. Comparison of Transitional, Current and Final Structure of the Turkish Electricity Market

	Transitional 2006-2011 Years	Current 2011-Present	Final structure 2014 or 2015
Bilateral contracts market	Yes	Yes	Yes
Day-ahead operation	Day-ahead planning by NLDC	Day-ahead market	Day-ahead market
Real time balancing	Yes	Yes	Yes
Balancing entities	Minimum 20 MW installed capacity	No limit	No limit
Balance responsibility	No	Yes	Yes
Bid types	Hourly bids	Hourly, flexible and block bids	Hourly, flexible and block bids
Frequency of bid price submits	Twice a month (for each settlement period)	Every day (for each hour)	Every day (for each hour)
Demand-side participation	No	Yes	Yes
Financial forwards market	No	No	Yes

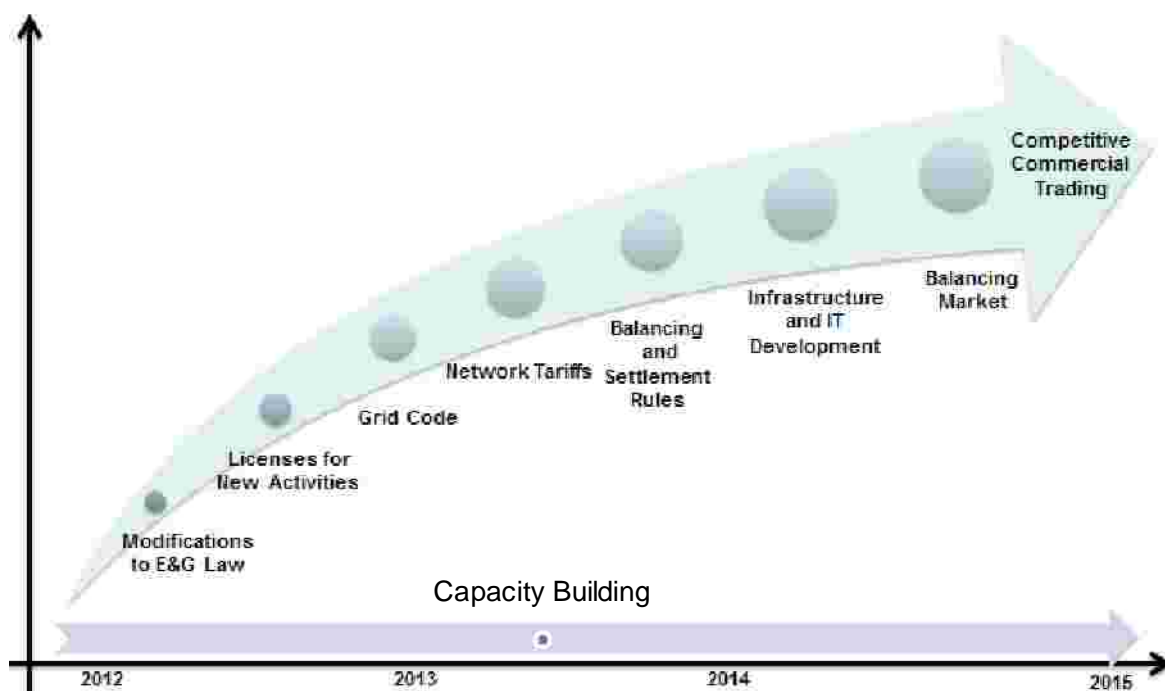
5. FURTHER DEVELOPMENT OF THE ELECTRICITY MARKET IN GEORGIA

The electricity sector in Georgia has made good progress in unbundling and technical improvements, but in terms of market development, there is significant development needed.

According to GEMM 2015, the gradual development of the sector towards competition includes the creation of the independent entities that will be responsible for the functioning of the electricity market: the MO and the TSO. These entities will be responsible for the implementation of the various markets required.

GEMM 2015 defines the major steps towards the creation of a competitive market in Georgia. The future vision is based on best international practices and harmonized with the EU requirements, as Georgia is a candidate for admission in the EU energy community. Evolution of the future Georgian electricity market and its accompanied required changes is shown in the Figure 9.

Figure 9. Evolution Path of the Georgian Competitive Market Design



References

Source materials used in this report can be found at the following locations.

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2. Energy Market Regulatory Authority, www.emra.gov.tr
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7. Nord Pool, www.nordpoolspot.com

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